TENA SOFTWARE MAINTENANCE DATA COLLECTION TASK SUMMARY

The Test and Training Enabling Network Architecture (TENA) Program Director tasked the MITRE Economic and Decision Analysis Center to conduct a two phased analysis of software maintenance programs currently maintained at test and training ranges. During the first phase which was conducted in fiscal year 1997 (FY 97), MITRE collected and analyzed current and projected software maintenance data from primary and secondary test and training ranges. The data will be used to assess the cost of maintaining and upgrading software currently within the test and training range community. Originally, the second phase of the analysis was planned for FY 98. MITRE would generate a cost estimate of developing and maintaining test and training range software developed for reuse under the TENA initiative. A cost benefit analysis would then be performed that incorporated phasing of TENA activities and products to show TENA's impact on the costs of test and training ranges' software. The results of Phase I provided limited data. Results are discussed below. The TENA Project Office used this data and subject matter experts to develop preliminary estimates of the cost benefit of using a Product Line Approach to developing and maintaining test and training ranges and resources. That work is included in Volume II of the TENA Baseline Report. The limited response to our Phase I initiative, together with the magnitude of the preliminary cost benefit results has caused us to reexamine the scope and utility of additional cost benefit studies at this time. This does not diminish our interest in more empirical cost data and accurate tracking of TENA cost benefits throughout its life-cycle.

The amount of software currently being maintained within the test and training range community is unknown. For Phase I, MITRE created a data collection questionnaire to collect software data for analysis of software maintenance programs currently operating at test and training ranges. The questionnaire was designed to obtain data and information from computer resources center, software management center, or equivalent organizations at test and training ranges. In conjunction with the questionnaire, MITRE performed interviews with range points of contact and site visits as additional techniques to collect data.

The purpose of this data collection effort was to develop an understanding of the types, quantity, and costs of software currently supported. Rather than solicit responses from the entire test and training range community, the questionnaire was first distributed only to primary and secondary test ranges of TENA team members

because of their vested interest in the TENA program. Depending on the success of obtaining data from these ranges, the questionnaire would then be provided to a wider audience within the entire test and training range community. However, responses to the questionnaire have been sporadic and incomplete. Apparently, general software data and software maintenance cost data were not readily accessible, available, or known.

The following TENA member ranges were provided the questionnaire and have provided some level of data: Electronic Proving Ground (EPG), Naval Air Warfare Center-Weapons (NAWC-WPNS) Point Mugu, Air Force Flight Test Center (AFFTC)-Edwards Air Force Base (AFB), Atlantic Fleet Weapons Training Facility (AFWTF), and Atlantic Undersea Test and Evaluation Center (AUTEC). The survey was also provided to NAWC-WPNS China Lake, Joint Interoperability Test Center (JITC), and Air Force Development Test Center (AFDTC) Eglin AFB, but no data has been provided by these ranges to-date. A site visit to the Aberdeen Proving Grounds-Aberdeen Test Center (APG-ATC) was also conducted where additional software data was collected. Also, the CDAPS database, which contains software data obtained from a survey performed by CDAPS personnel, was obtained and included software data for White Sands Missile Range (WSMR), NAWC-Patuxent (Pax) River, and Arnold Engineering Development Center.

A summary of the information that we were able to collect from the various ranges is provided below:

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EPG

LOC (including comments):18,626

SLOC: 16,763

- Operational software early in life cycle

- No formal release cycle (except for RTData)

- Formal TRs not used

- Ten percent of RTData SLOC modified/release

- Heavy concentration on adaptive (enhancement) activity

- Applications not common to other ranges outside of EPG

- Small maintenance staff

- Functionality:

- Interactive test range

- Operational applications run on the radar

- Allows data passing to support systems (FEP)

- Support software applies a three pass approach to reducing and presenting radar data in final user format

NAWC-WPNS Pt. Mugu

LOC (including comments):237,000

SLOC: 188,280

- Mature systems with minimal maintenance required

- Minimal STRs corrected/release and SLOC affected/release

- Even split between corrective and enhancement activity

- Recent transition to a distributed, workstation-class system

- Functionality:

- Software infrastructure for constructing custom real time applications

- Generate setup files for real time applications and display systems

- Menu driven software display and control system to provide real time telemetry, surveillance, geographic, and precision instrumentation data displays for operations control, target control, vehicle tracking, system training, and range safety

- Custom real time applications that support test/exercises-control of target aircraft/missiles, display of tracking/surveillance TSPI data

- Post-test data processing

AFFTC

LOC (including comments):913,488

SLOC: 588,010

- ADAPS new range processor (replaces IFDAPS)

- Other Systems data not provided yet (ARGUS and EDS)

- ADAPS not transitioned to life cycle yet

- APTAS large number of installations

- Heavy C/C++ oriented (APTAS heavy in Java)

- Six month release cycles, 150 STRs corrected/release, 30,000 SLOC affected/release

- Software unique to range

- Heavily concentrated in enhancement activity

- Functionality:

- Telemetry processing systems

- Auxiliary processing and analysis systems

- Post-test analysis systems

- Financial tracking system (ARGUS)

- Range resource scheduler (EDS)

AFWTF

Lines of Code (LOC) (including comments):622,009

Source Lines of Code (SLOC): 551,058

- High processor utilization

- Two new CSCIs: CIT and Replacement RTDS

- Other CSCIs well into life cycle

- Short release cycles, low number of Software Trouble Reports (STRs) corrected/release, low number of SLOC affected/release

- Software unique to range (except for UTR)

- Mix of corrective, enhancement, and growth activities performed

- Functionality:

- Track data collection

- Protocol translator

- Tactical Display

- Real time Training

- Managing range operations-processes and displays real time data

- Post mission playback

- Scheduling facilities

- Inventory control

AUTEC

LOC (including comments):2,397,616

SLOC:

- Functionality:

- Tracking solutions, data filtering/archiving, network data transmission

- Manipulating tracking data

- Tracking system

- Data collection, record keeping

- Pre and post-test

APG-ATC

LOC (including comments):413,086

SLOC:315,461

- Mix of heavy and light processor utilization

- Most CSCIs relatively early in the life cycle (except for BTST)

- 20 percent of total code is comments

- Number of installations vary

- Release cycles range from 6 months to 36 months

- STRs/release ranges from 1 to 100

- SLOC modified/release ranges from 50 to 2,500

- Concentration of activity on enhancements and growth

- Some software common with other ranges

- Functionality:

- Ballistic testing

- Target video scoring

- Vibration testing

- Fire control

- Automated data collection

- Test incident reports

- Direct fire testing

- On-board embedded data acquisition system

A summary of the total lines of code currently at ranges that we were able to obtain data from are provided in the table below:

Range	Lines of Code
APG-ATC	413,000
EPG	19,000
NAWC-WPNS Pt. Mugu	237,000
AFFTC	913,500

AFWTF	622,000
AUTEC	2,400,000
WSMR	420,600
NAWC-Pax River	279,000
Arnold Engineering Center	700,000
Total	6,004,100

MITRE continues to follow-up on data collection with several of these ranges.